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IS 12535-2 (1991): Automotive vehicles - Transmission systems - Glossary, Part 2: Universal joints and driveshafts [TED 2: Automotive Primemovers]

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“Knowledge is such a treasure which cannot be stolen”





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भाग 2 यूनिवर्सल जोड़ तथा ड्राइवशाफ्ट

*Indian Standard*

**AUTOMOTIVE VEHICLES — TRANSMISSION  
SYSTEMS — GLOSSARY**

**PART 2 UNIVERSAL JOINTS AND DRIVESHAFTS**

UDC 621.825.6 : 629.113 : 001.4

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**BUREAU OF INDIAN STANDARDS**  
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## Automotive Transmission Systems Sectional Committee, TED 3

### FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Transmission Systems Sectional Committee had been approved by the Transport Engineering Division Council.

The other parts of this Indian Standards are:

IS 12535 (Part 1) : 1988    Automotive    vehicles — Transmission    systems — Glossary:  
Part 1 General

IS 12535 (Part 3) : 1991    Automotive    vehicles — Transmission    systems — Glossary:  
Part 3 Drive axle

In the preparation of this standard considerable assistance has been derived from SAE J 901 b  
“Universal joints and driveshafts — Nomenclature and terminology”.

*Indian Standard***AUTOMOTIVE VEHICLES — TRANSMISSION SYSTEMS — GLOSSARY****PART 2 UNIVERSAL JOINTS AND DRIVESHAFTS****1 SCOPE**

**1.1** This standard (Part 2) specifies the terms and definitions relating to universal joints and driveshafts used in automotive drive train applications are covered.

**1.2** The Rzeppa, Weiss, Tracta and Tripot universal joints are used primarily in slower speed applications, such as wheel drives.

**2 TERMINOLOGY****2.1 Universal Joints**

A mechanical device which can transmit torque and/or rotary motion from one shaft to another at fixed shaft angles or when the intersecting shaft angle changes.

**2.2 Non-constant Velocity Universal Joint**

A universal joint which transmits motion with a variation in angular velocity between the output and input shaft when operated at an angle greater than zero. The average angular velocity ratio is unity (see Fig. 1 and 2).

**2.3 Constant Velocity or CV Universal Joint**

A universal joint which transmits motion with an angular velocity ratio of unity between output and input shafts (see Fig. 3, 4, 5 and 6).

**2.4 Near Constant Velocity Universal Joint**

A universal joint which transmits motion with an angular velocity ratio of unity when operated at the design angle. When operated at other angles, the angular velocity ratio is near unity (see Fig. 7 and 8).

**2.5 Self-Supporting Universal Joint**

A universal joint supported by internal means (see Fig. 1 to 4, 6 and 7).

**2.6 Non-Self-Supporting Universal Joint**

A universal joint which requires an external means of support (see Fig. 5 and 8).

**2.7 True Joint Angle**

The acute angle described by the intersection of the rotational axes of the input and output shafts of a universal joint and measured in the plane described by these axes.

**2.8 Swing Diameter**

The maximum diameter of the circular path described by a rotating universal joint.

**2.9 Constant Velocity (or Homokinetic) Plane**

The plane described by the driving engagement points of a universal joint which produces an angular velocity ratio of unity between the output and input shafts. This plane bisects the obtuse angle formed by the output and input shaft rotational axes and is normal to the plane containing these axes.

**3 NON-CONSTANT VELOCITY UNIVERSAL JOINTS****3.1 Cardan or Hooke's Universal Joint**

A non-constant velocity universal joint which consists of two yokes joined by a cross (see Fig. 1).

**3.1.1 Yoke**

The basic torque and/or motion input and output member with drivable means of attachment (see Fig. 1).

**3.1.2 Cross**

The intermediate drive member which has four equally spaced trunnions in the same plane (see Fig. 1).

**3.2 Ball-and-Trunnion Universal Joint**

A non-constant velocity universal joint, radially self-supported, which consists of a housing drivable connected to a ball head through a pair of trunnions mounted in diametrically opposed balls and permits axial movement (see Fig. 2).

**3.2.1 Housing**

A member with two partly cylindrical, diametrically opposed, axial bores and drivable means of attachment (see Fig. 2).

**3.2.2 Ball**

A spherical — shaped member which pivots and transmits load from the housing to the ball head through needle rollers and the pin, and permits axial movement (see Fig. 2).

**3.2.3 Button**

A thrust loaded member used to locate the ball head assembly (see Fig. 2).

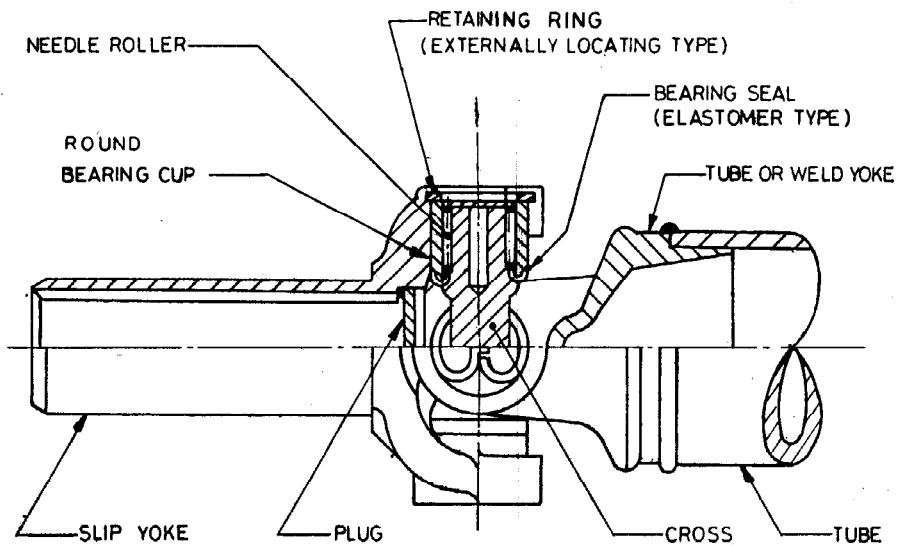


FIG. 1 CARDAN UNIVERSAL JOINT

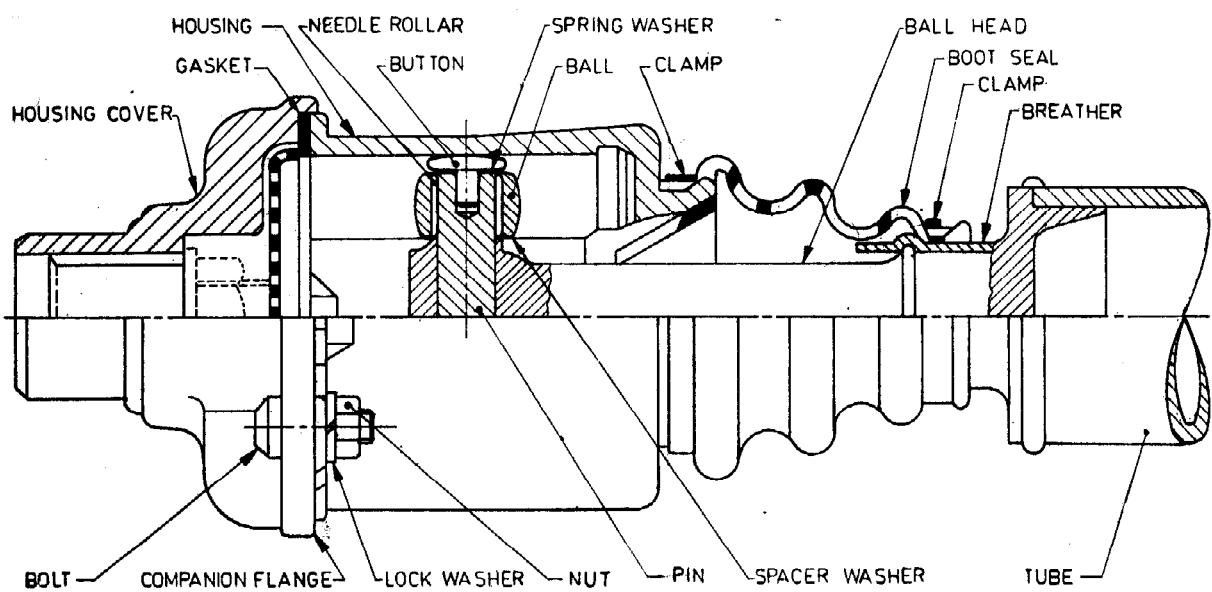


FIG. 2 BALL AND TRUNNION UNIVERSAL JOINT

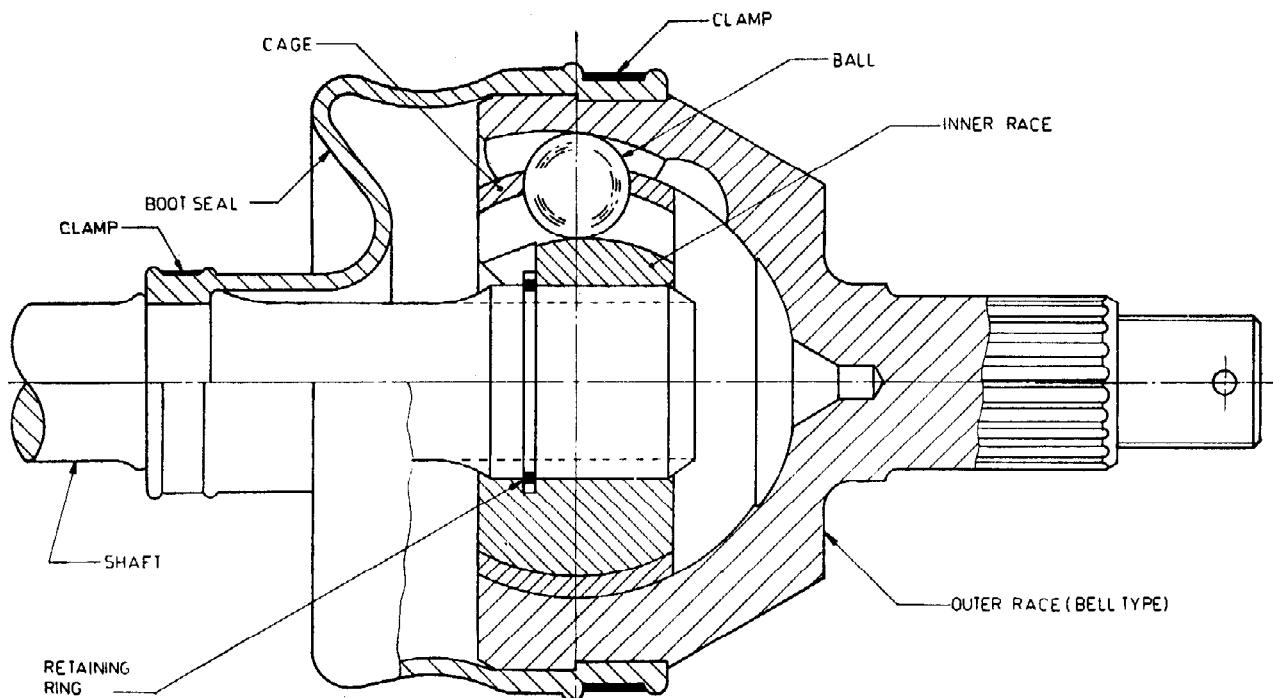


FIG. 3 RZEPKA UNIVERSAL JOINT (BELL TYPE)

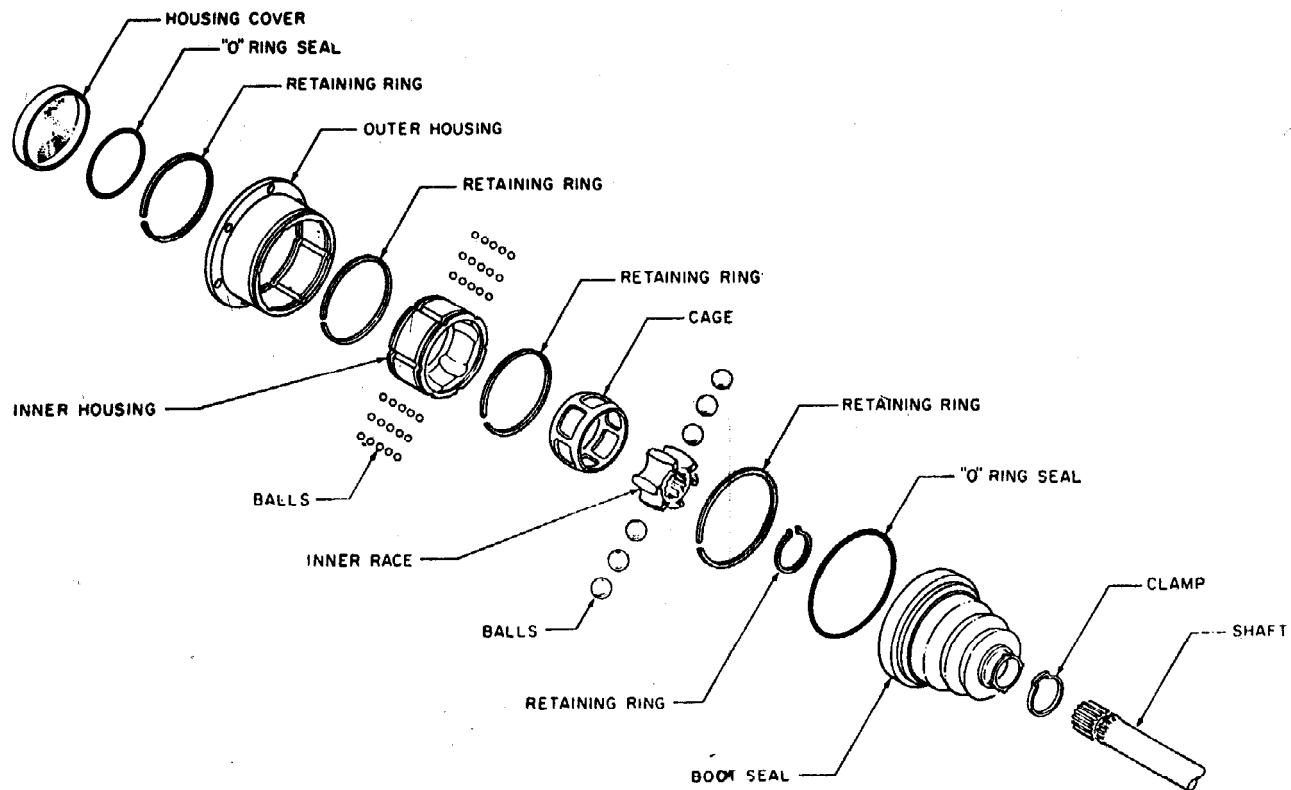


FIG. 4 BALL SPLINE RZEPPA UNIVERSAL JOINT

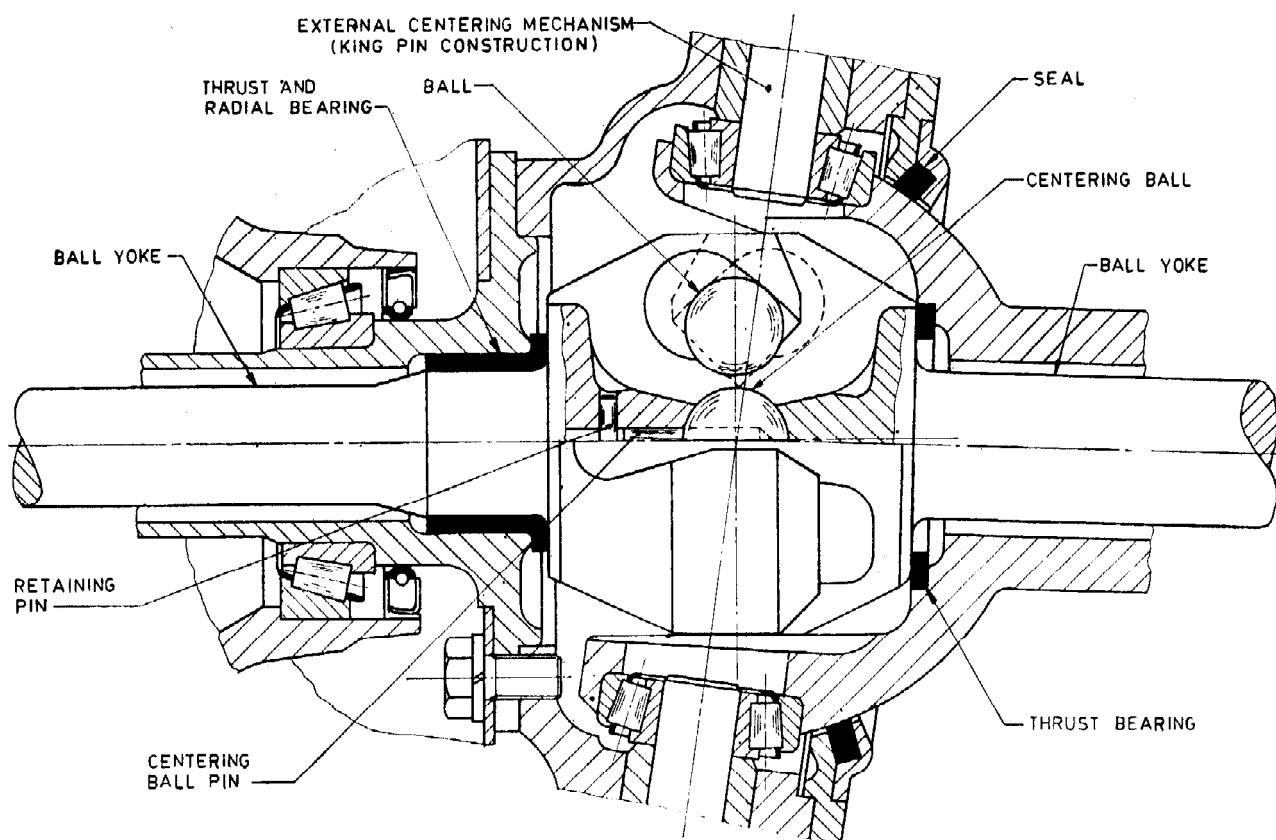


FIG. 5 WEISS UNIVERSAL JOINT (CURVED GROOVED TYPE), WHEEL POSITION APPLICATION

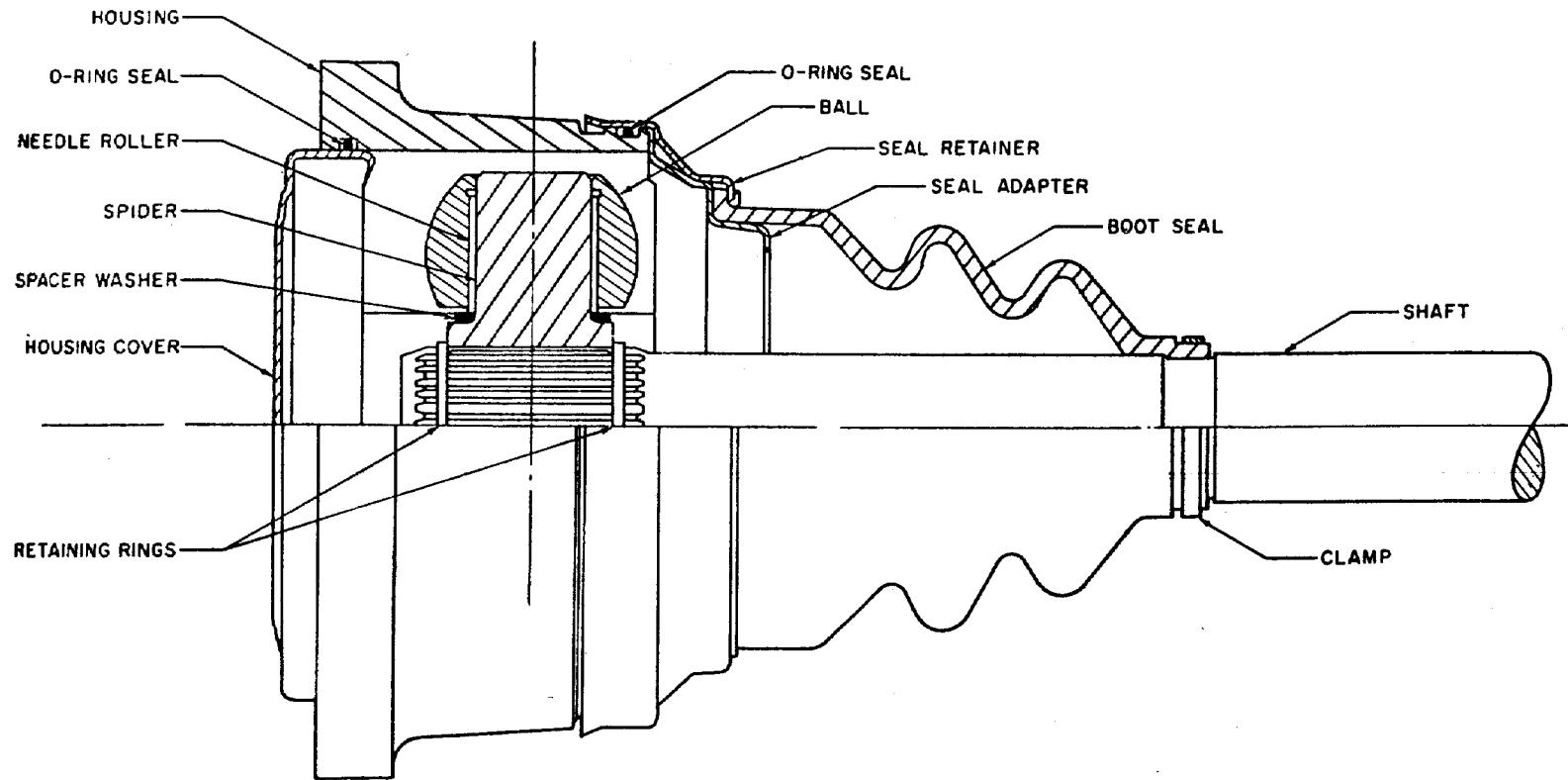


FIG. 6 TRIPOT UNIVERSAL JOINT

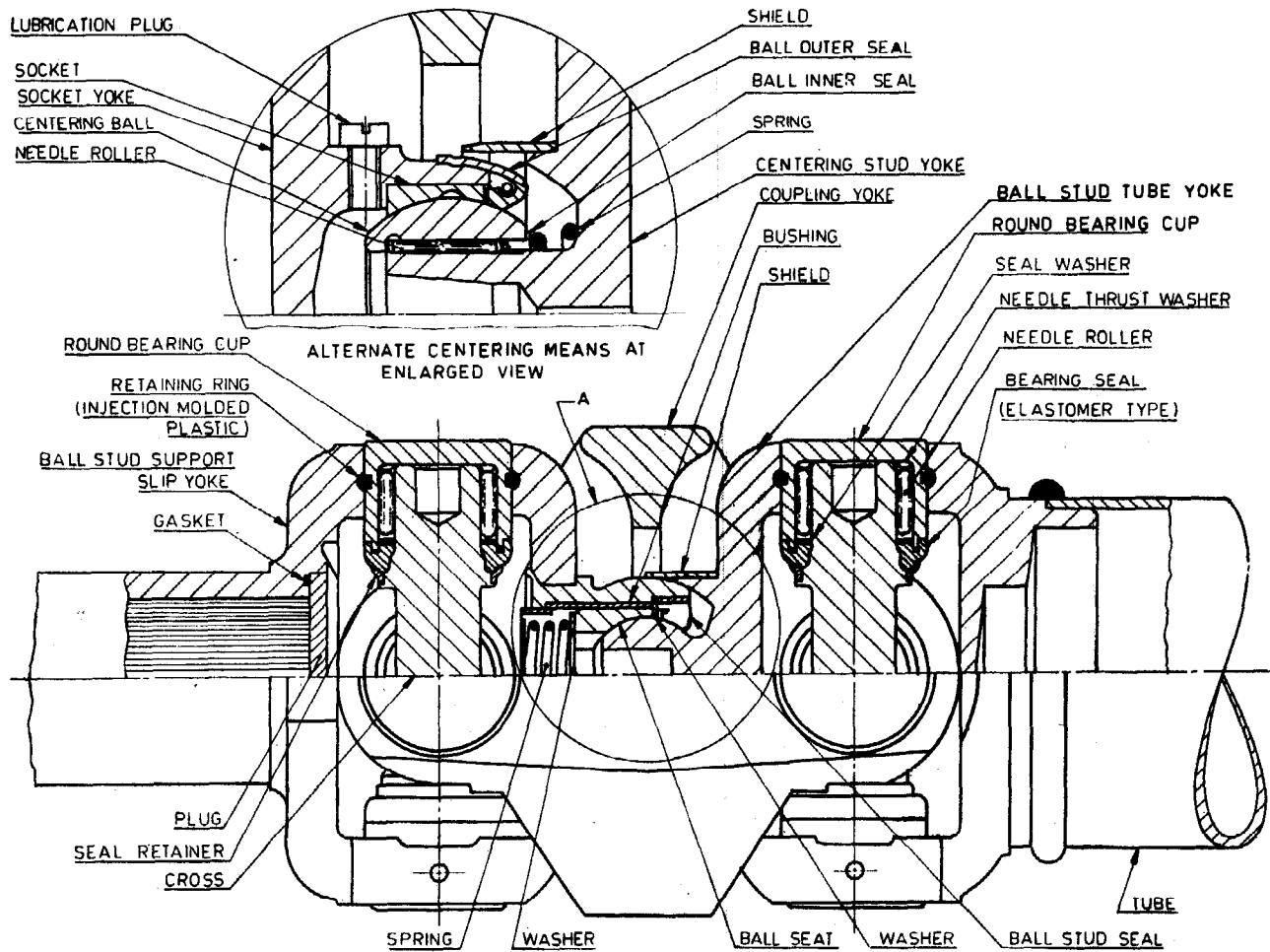


FIG. 7 DOUBLE CARDAN UNIVERSAL JOINT

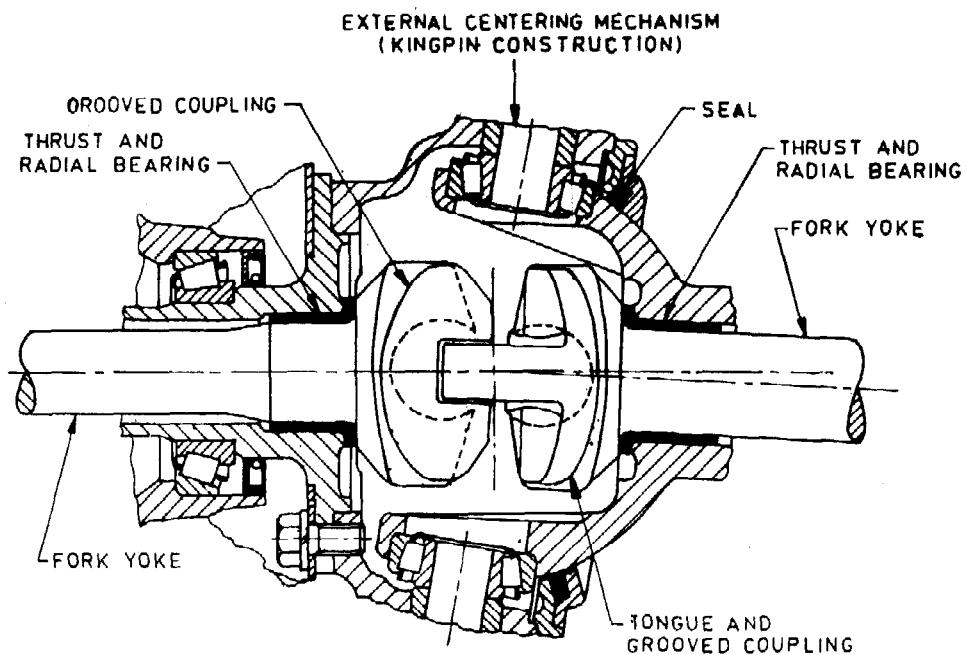


FIG. 8 TRACTA UNIVERSAL JOINT, WHEEL POSITION APPLICATION

### 3.2.4 Ball Head

A member which provides for the transversely located pin and has a drivable means of attachment ( see Fig. 2 ).

## 4 CONSTANT VELOCITY UNIVERSAL JOINTS

### 4.1 Rzeppa Universal Joint

A self-supported, constant velocity Universal joint which consists of an outer and inner-race drivable connected through balls located in meridionally curved grooves in the races and positioned in the constant velocity plane by a cage located between the two races. All major rotating mass elements have constant velocity ( see Fig. 3 ).

#### 4.1.1 Outer Race ( Bell Type )

A bell shaped member with a drivable means of attachment which has meridionally located ball grooves on a spherical inner bearing surface ( see Fig. 3 and 9 ).

#### 4.1.2 Inner Race

An annular member with meridionally located ball grooves on the spherical outer bearing surface and with internally splined drivable means of attachment ( see Fig. 3, 4 and 9 ).

#### 4.1.3 Cage

A ring-like member which has outer and inner spherical bearing surfaces and a circumferential series of openings for positioning balls ( see Fig. 3, 4 and 9 ).

### 4.2 Ball Spline Rzeppa Universal Joint

A disc-type Rzeppa constant velocity universal joint that will permit axial motion by means of an integral ball spline ( see Fig. 4 ).

#### 4.2.1 Outer Housing

An annular member with axial ball spline grooves in its bore and drivable means of attachment ( see Fig. 4 ).

#### 4.2.2 Inner Housing

A disc-type Rzeppa outer race with axial ball spline grooves on its cylindrical outer surface ( see Fig. 4 ).

### 4.3 Weiss Universal Joint ( Curved Groove Type )

A constant velocity universal joint which consist of two yokes drivable connected through balls located in the constant velocity plane by non-concentric intersecting grooves symmetrically positioned in radial planes and restrained as an assembly by a piloted centering ball. An external seal and axial support means are required. All major rotating mass elements have constant velocity ( see Fig. 5 ).

### 4.3.1 Ball Yoke

A yoke shaped member with curved ball grooves located in radial planes on the inside of the yoke ears and integral means of attachment ( see Fig. 5 and 10 ).

### 4.3.2 Centring Ball

A ball that centres the universal joint, absorbs end thrust, and has a hole for a pin that positions the universal joint components as an assembly ( see Fig. 5 and 10 ).

### 4.4 Tripot Universal Joint

A constant velocity universal joint, radially self-supported, which consists of a housing drivable connected to a shaft through three equally spaces trunnion mounted balls and permits axial movement ( see Fig. 6 ).

#### 4.4.1 Housing

A member with three partly cylindrical equally spaced axial bores and drivable means of attachment ( see Fig. 6 and 11 ).

#### 4.4.2 Spider

A member with three equally spaced trunnions in the same plane and with internally splined drivable means of attachment ( see Fig. 6 and 11 ).

## 5 NEAR CONSTANT VELOCITY UNIVERSAL JOINTS

### 5.1 Double Cardan Universal Joint

A near constant velocity universal joint which consists of two cardan universal joints whose crosses are connected by a coupling yoke with internal supporting and centring means and has intersecting shaft axes. At the design joint and at zero, the instantaneous angular velocity ratio is unity while at other joint angles, it is near unity ( see Fig. 7 ).

### 5.2 Tracta Universal Joint

A near constant velocity universal joint which consists of two yokes drivable connected through plane surfaces to two intermediate coupling similarly engaged and requires external supporting, centering and sealing means ( see Fig. 8 ).

#### 5.2.1 Fork Yoke

A fork-shaped member with plane surfaces used for engaging the mating groove of an intermediate coupling and with integral means of attachment ( see Fig. 8 and 12 ).

#### 5.2.2 Tongue and Groove Coupling

A hemispherically shaped intermediate member with tongue and groove located normal to each other ( see Fig. 8 and 12 ).

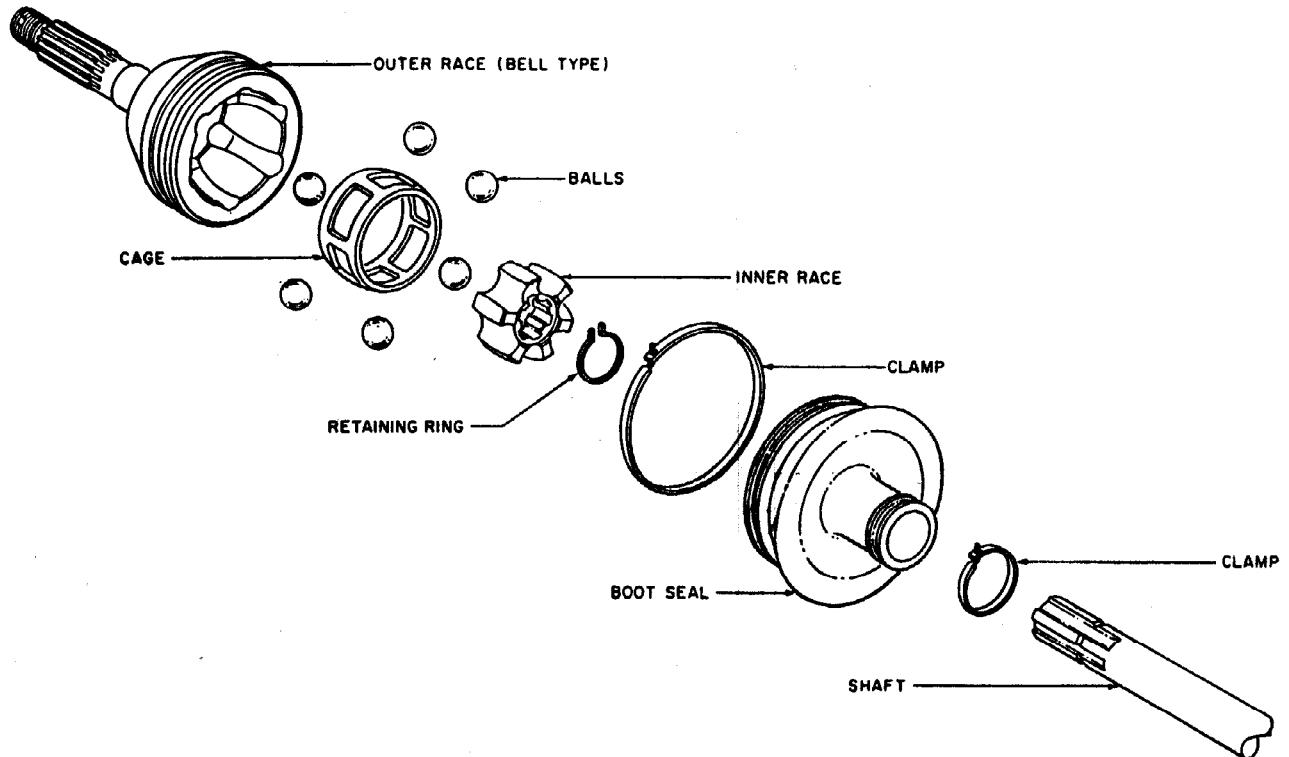


FIG. 9 RZEPPA UNIVERSAL JOINT ( BELL TYPE )

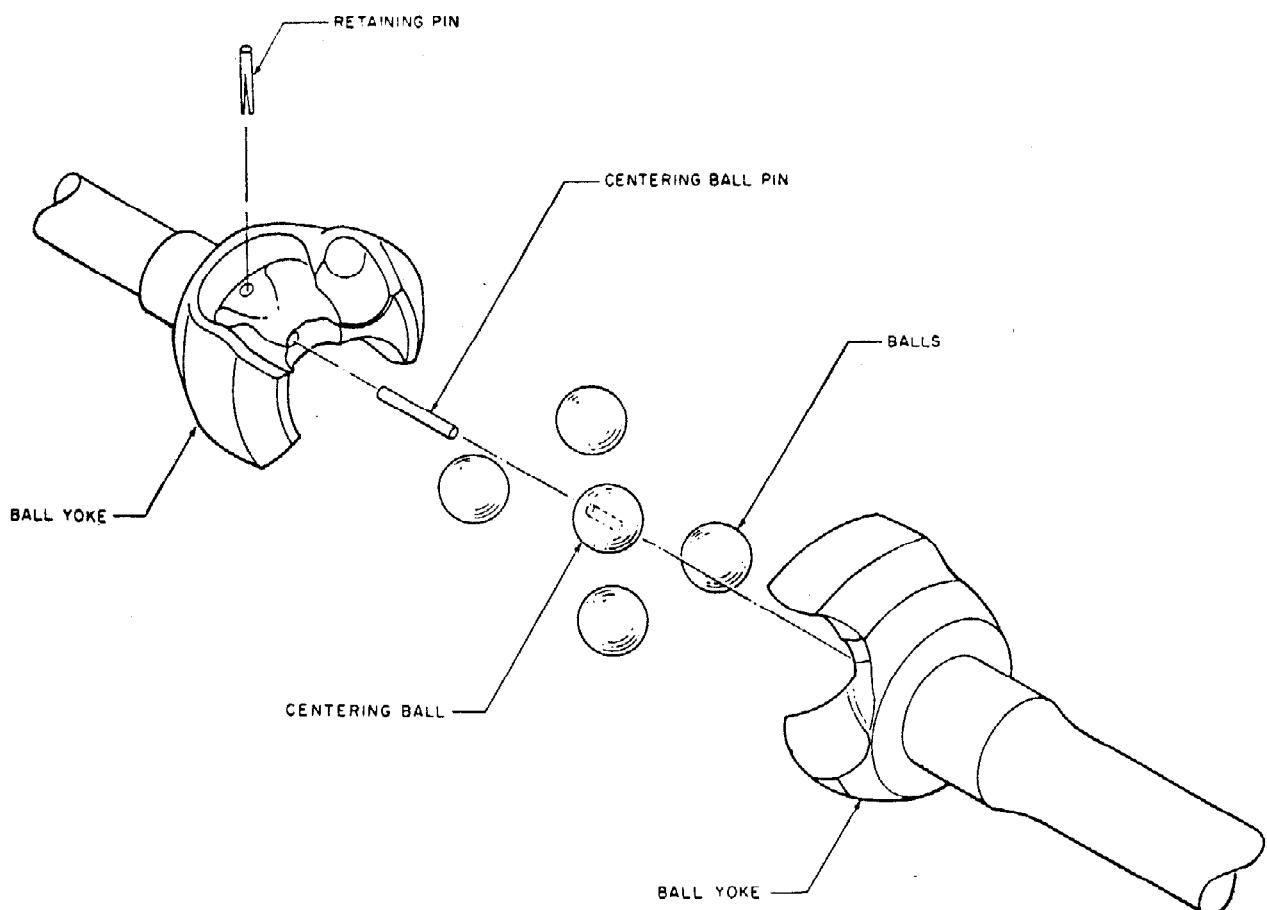


FIG. 10 WEISS UNIVERSAL JOINT ( CURVED GROOVED TYPE )

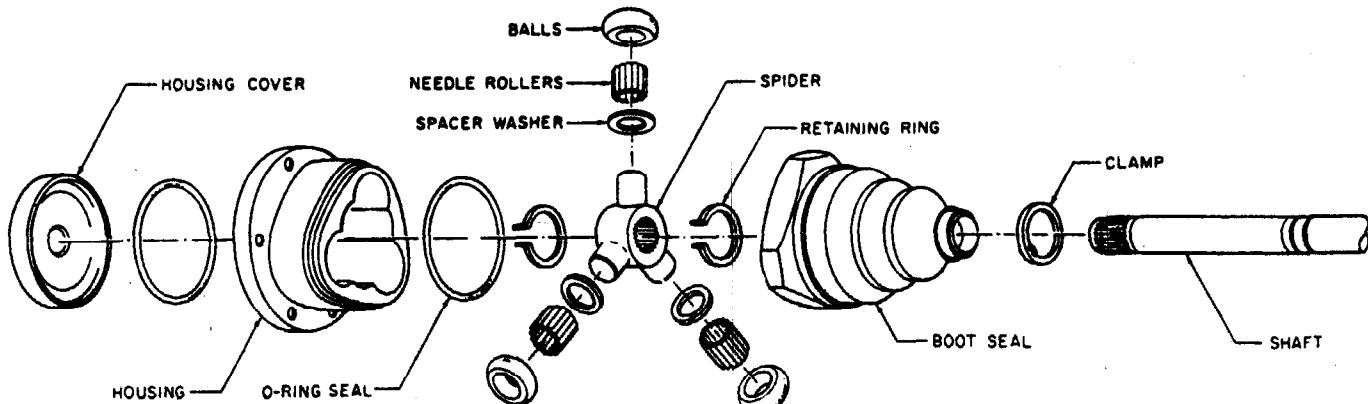


FIG. 11 TRIPOT UNIVERSAL JOINT ( EXPLODED VIEW )

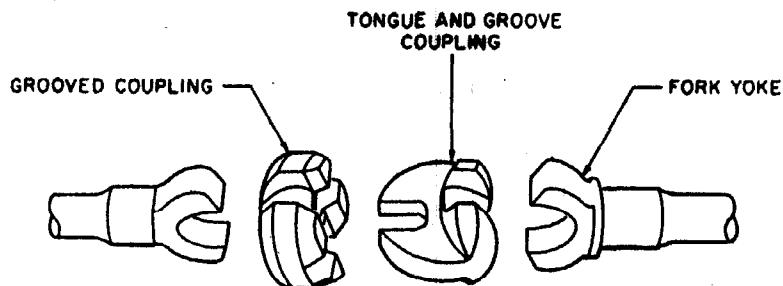


FIG. 12 TRACTA UNIVERSAL JOINT

### 5.2.3 Grooved Coupling

A hemispherically shaped intermediate member with two grooves located normal to each other (see Fig. 8 and 12).

## 6 DRIVESHAFTS

### 6.1 Driveshaft

An assembly of one or two universal joints connected to a solid or tubular member. Typical driveshaft constructions are shown in Fig. 13 and a typical two-joint driveshaft arrangement is shown in Fig. 14.

### 6.2 Driveline

An assembly of one or more driveshafts with provisions for axial movement, which transmits torque and/or rotary motion at a fixed or varying angular relationship from one shaft to another.

### 6.3 Driveshaft Length, Centre to Centre

The distance between the outermost universal joint centres on a driveshaft. While on driveshafts having fixed centres, it is the nominal dimensions, it is the compressed and extended lengths on driveshafts having variable length centres (see Fig. 13).

### 6.4 Slip

The permissible length of axial travel.

### 6.5 Phase Angle

The relative rotational position of the universal joint yokes on a driveshaft (see Fig. 13).

## 7 DRIVESHAFT TYPES

### 7.1 Two-Joint Outboard Slip Driveshaft

A driveshaft or part of a driveline or part of a driveline having a universal joint at each end. Axial movement is provided outboard of joint centres (see Fig. 13).

An exploded view of a two-joint outboard slip driveshaft with alternate component constructions is illustrated in Fig. 15.

### 7.2 Two-Joints Inboard Slip Driveshaft

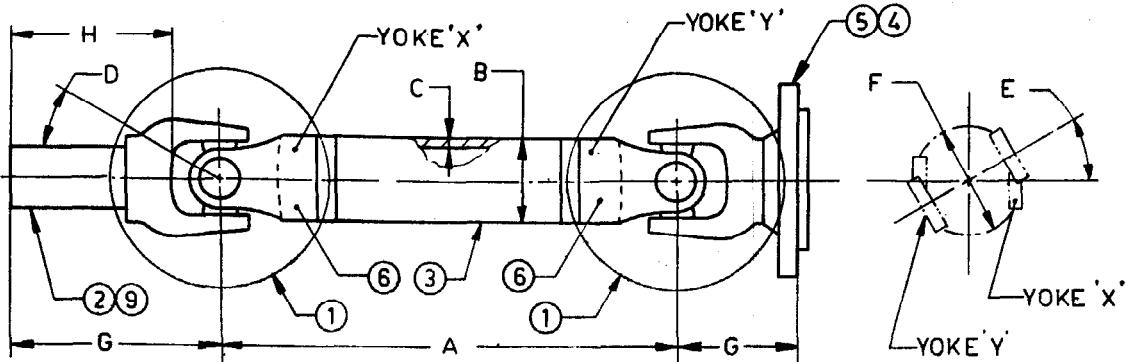
A driveshaft or part of a driveline having a universal joint at each end. Axial movement is provided inboard of joint centres (see Fig. 13).

### 7.3 Single Joint Coupling Shaft

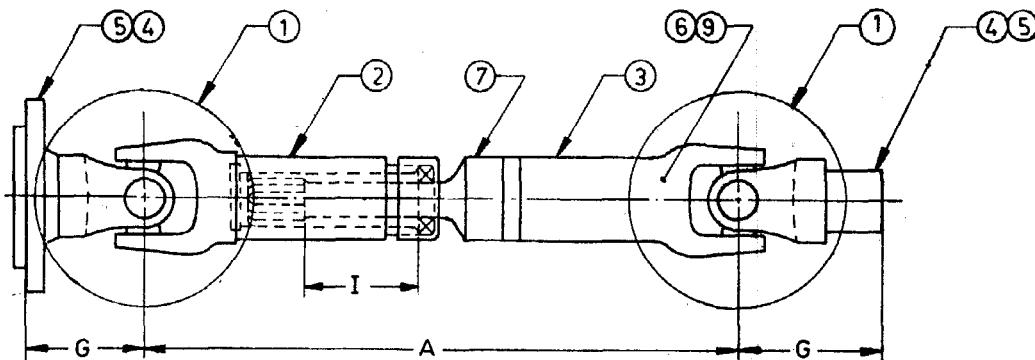
The coupling member or members of a multiple joint driveline consisting of one universal joint, tube, shaft support, and slip spline or fixed spline shaft (see Fig. 13).

Typical driveshaft arrangements are shown schematically in Fig. 16 and 17.

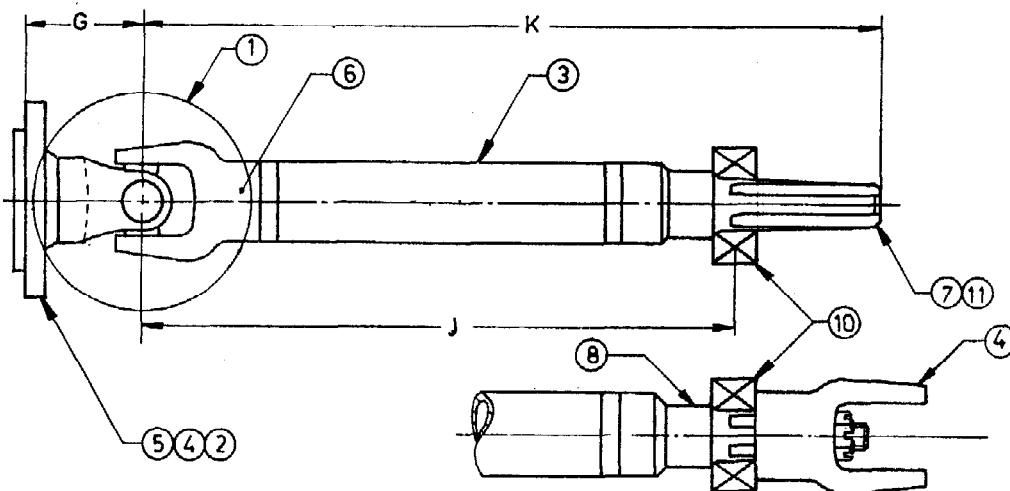
Typical Cardan universal joint bearing and retainer types are illustrated in Fig. 18.



TWO JOINT OUTBOARD SLIP DRIVESHAFT



TWO JOINT INBOARD SLIP DRIVESHAFT



SINGLE JOINT COUPLING SHAFT

|                                     |   |
|-------------------------------------|---|
| 1 UNIVERSAL JOINT                   | A FIXED OR COMPRESSED DRIVE SHAFT LENGTH            |
| 2 SLIP YOKE (INTERNAL SPLINED)      | JOINT CENTER TO CENTER                              |
| 3 TUBE                              | B TUBE DIAMETER                                     |
| 4 END YOKE                          | C WALL THICKNESS                                    |
| 5 FLANGE YOKE                       | D JOINT ANGLE                                       |
| 6 TUBE OR WELD YOKE                 | E PHASE ANGLE                                       |
| 7 SLIP SHAFT (EXTERNAL SPLINED)     | F SWING DIAMETER                                    |
| 8 NON-SLIP SHAFT (EXTERNAL SPLINED) | G OVER ALL LENGTH OF COMPONENT                      |
| 9 SLIP YOKE (EXTERNAL SPLINED)      | H SPLINED LENGTH OF COMPONENT                       |
| 10 SHAFT SUPPORT                    | I AVAILABLE SPLINE SLIP                             |
| 11 SLIP SHAFT (INTERNAL SPLINED)    | J LENGTH FROM JOINT CENTER TO CENTERLINE OF BEARING |
|                                     | K LENGTH FROM JOINT CENTER TO SPLINED SHAFT END     |

FIG. 13 TYPICAL DRIVESHAFT CONSTRUCTION

KEY

E-ENGINE  
T-TRANSMISSION  
AT-AUXILIARY TRANSMISSION

TC-TRANSFER CASE  
FA-FRONT AXLE  
RA-REAR AXLE

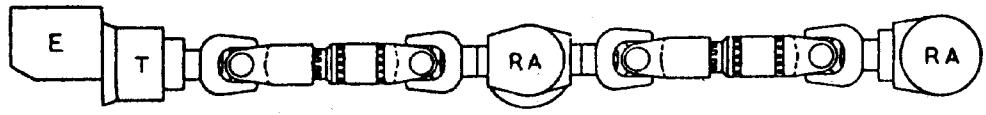
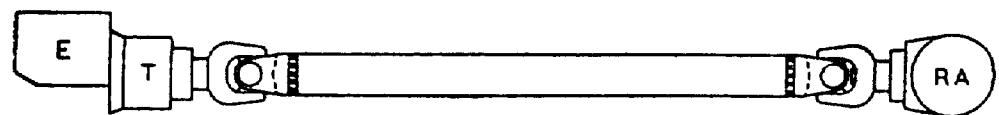
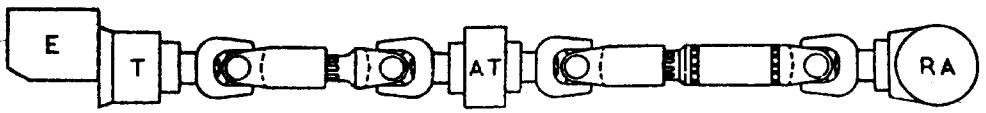
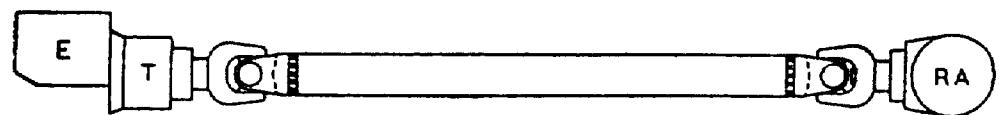


FIG. 14 TYPICAL TWO-JOINT DRIVESHAFT ARRANGEMENTS

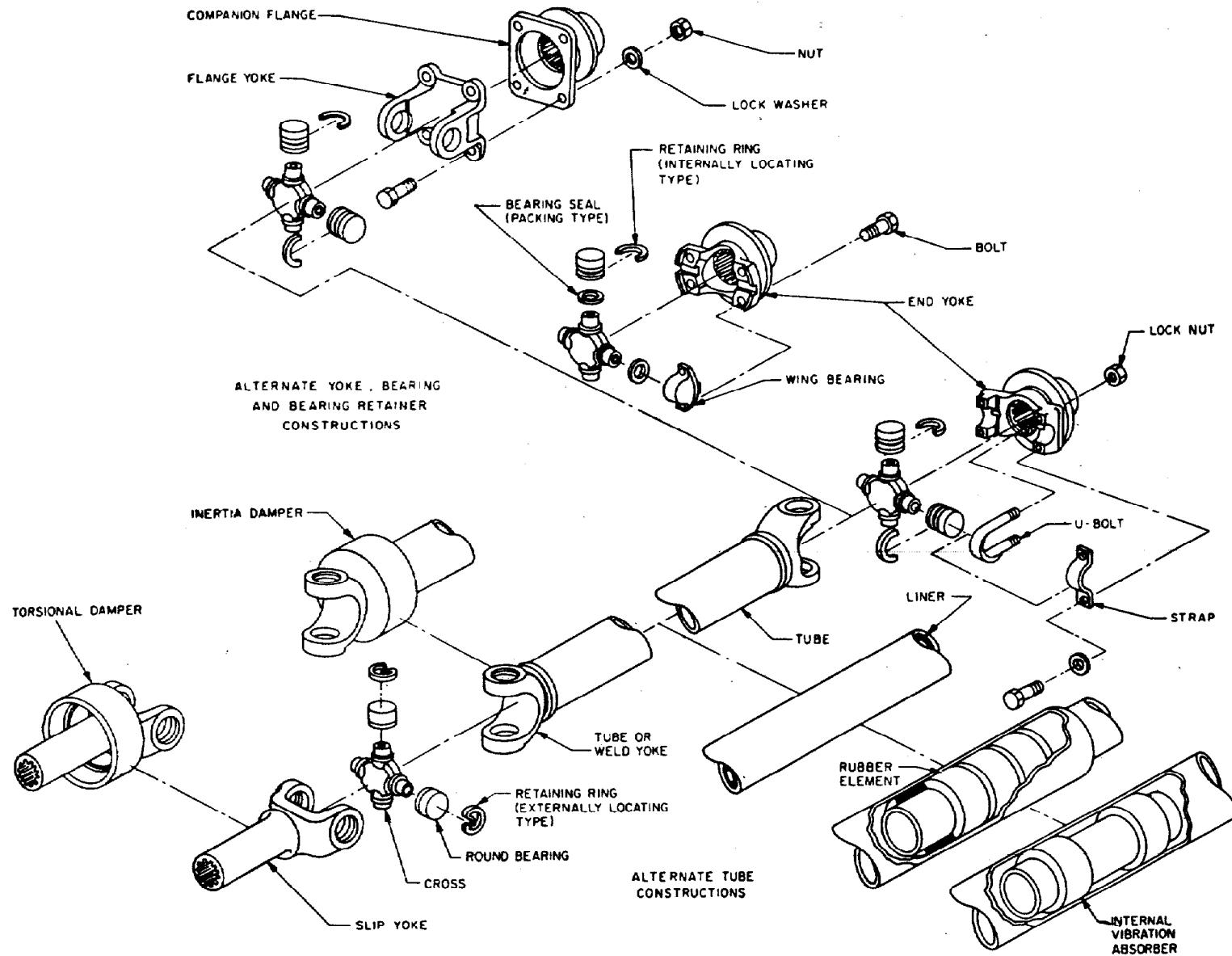
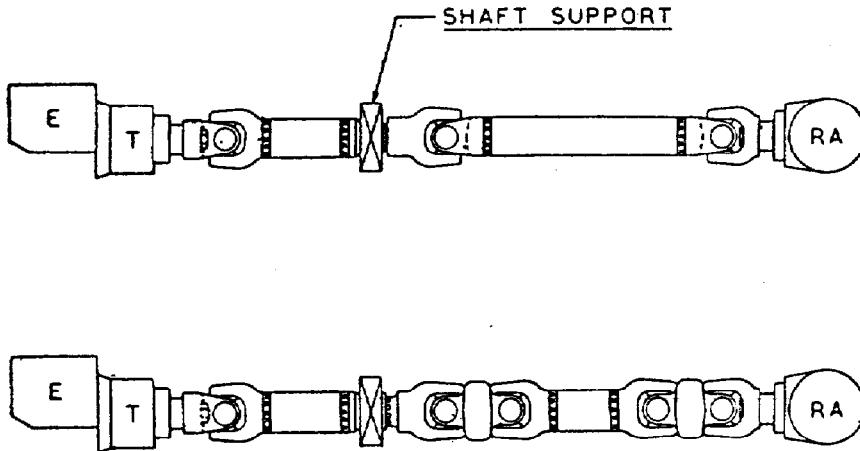


FIG. 15 TWO-JOINT OUTBOARD SLIP DRIVESHAFT ( PASSENGER CAR OR LIGHT TRUCK TYPE )



KEY

E - ENGINE

T - TRANSMISSION

RA - REAR AXLE

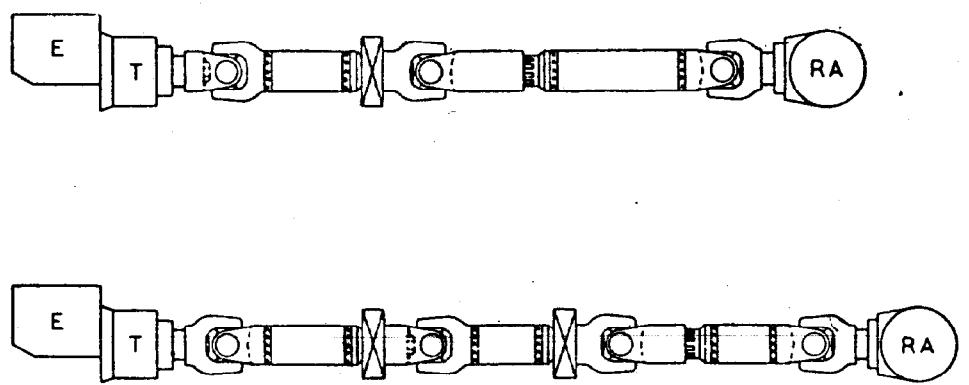
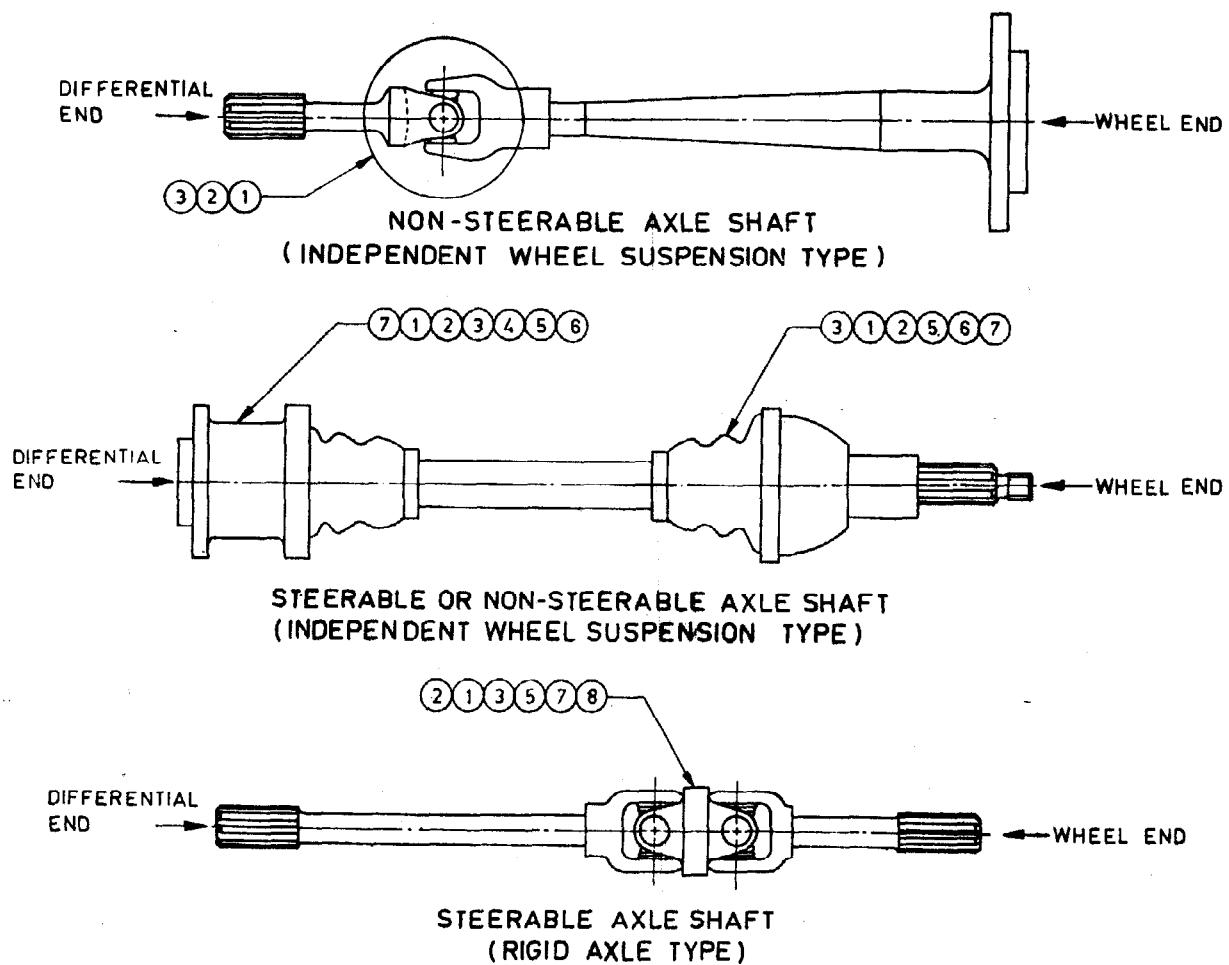


FIG. 16 TYPICAL MULTIJoint DRIVESHAFT ARRANGEMENTS



1- CARDAN      3- RZEPPA      5- WEISS      7- TRIPOT  
 2- DOUBLE CARDAN      4- BALL SPLINE RZEPPA      6- BALL AND TRUNNION      8- TRACTA

FIG. 17 TYPICAL WHEEL DRIVESHAFT ARRANGEMENT

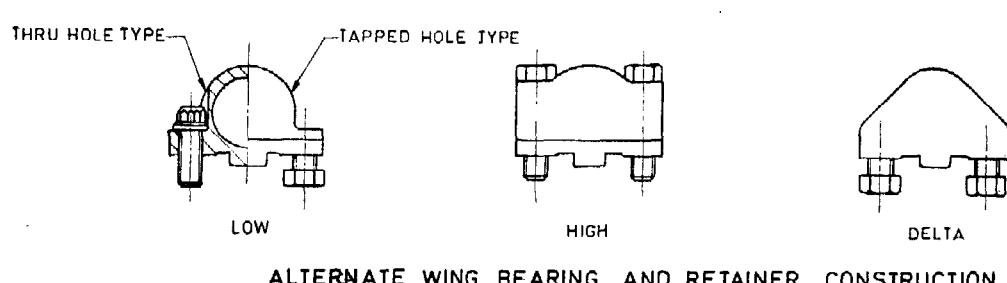
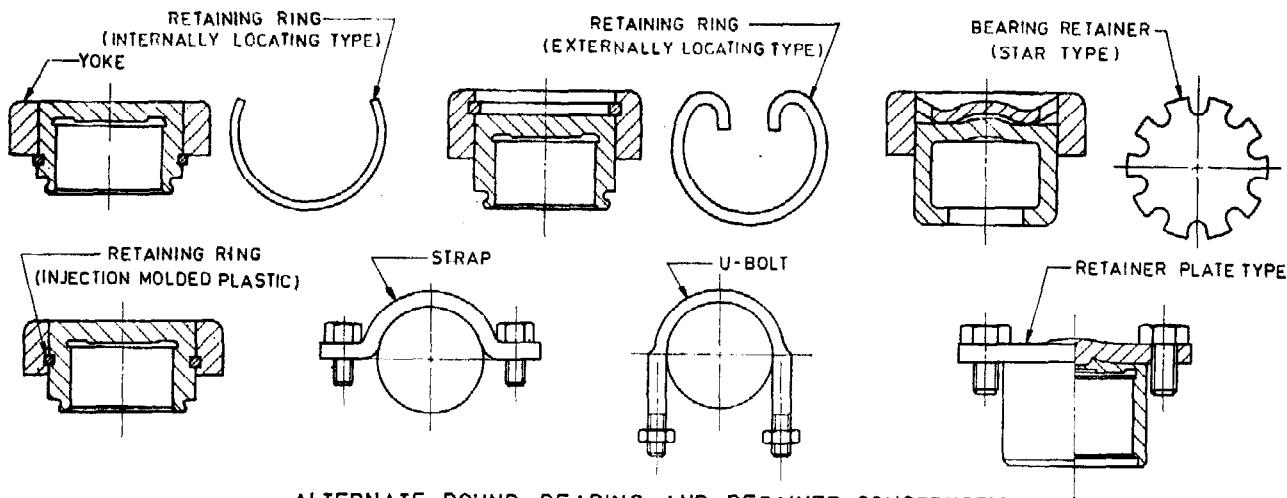


FIG. 18 UNIVERSAL JOINT BEARING AND RETAINER TYPE

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